



NASA-JSC's Vapor Corrosion Cell Cleans Up Environment

The presence of corrosives in the Earth's atmosphere is of global concern. From acid rains that are destroying forests and disfiguring monuments such as the Parthenon and the pyramids, to atmospheric pollutants that produce smog and induce emphysema in a significant number of people, the introduction of corrosives and other pollutants into the atmosphere is a critical and continuing environmental issue. No less critical to the space program is the presence of corrosives (reactive gases and water vapor) that are generated as byproducts of the launch process. The vapor corrosion cell developed for NASA can be used to detect corrosives early in the formation process; that is, before significant quantities are vented into the atmosphere.

The development of the vapor corrosion cell lead to procedures that, if followed, are expected to help clean up the environment by severely limiting the harmful effects of such corrosive gases as nitrogen dioxide, hydrogen chloride, sulfur dioxide, and acidic aerosols. The availability of the vapor corrosion cell is also expected to encourage the testing and development of alloys that will prove resistant to corrosion. Moreover, by detecting corrosives at an early stage, the vapor corrosion cell can help to reduce costs, save time, and increase safety margins.

In an atmosphere filled with chemically reactive gases and water vapor, such as are present at liftoff on a launch pad. The cell contains strips of alternating, dissimilar, electrically conductive materials — elemental metals or alloys — separated by thin strips of an electrically nonconductive material. In the example of the figure, the dissimilar electrically conductive materials are aluminum and titanium. This device is responsive to (1) the pressures of reactive vapors and the concentration of water vapor in the atmosphere; (2) the nature and surface areas of the two dissimilar conductors; (3) the nature and thickness of the electrically nonconductive separator; and (4) the ambient temperature. By controlling all but one of these parameters, one can operate the vapor corrosion cell in such a manner as to use it to measure

the remaining parameters.

The vapor corrosion cell measures air pollutants and the corrosive effects of such pollutants on metal structures. It enables the development of criteria, based on resistance to corrosion, for better selection of materials. This device can be employed around launch platforms to perform real-time corrosion measurements and to provide data for predicting the life expectancies of metals exposed to corrosives. The device can also be used on aircraft platforms or ships to monitor the environment. At present, this device is used to address a major environmental concern - that of measuring corrosion caused by acid gases generated as byproducts of industrial chemical processes. This device becomes a new and valuable ally in the early detection of corrosives.

The vapor corrosion cell is expected to be vital not only in the space program but also in the military, in activities and institutions that focus on the environment, in the aviation industry, and in any other industries, institutions, and activities in which there are risks that chemical processes will produce corrosive byproducts. Initial testing has shown that the vapor corrosion cell is highly sensitive to corrosives and that the cell can be reversed and rejuvenated to enable multiple measurements. For this reason, the vapor corrosion cell is a significant step towards redressing the imbalance caused by the release of corrosives into the atmosphere through chemical processes. This technology is currently available for license.

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